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EXAMINER
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SMOOT, STEPHEN W

ART UNIT	PAPER NUMBER
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2813

NOTIFICATION DATE	DELIVERY MODE
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11/17/2010

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

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<b>Office Action Summary</b>	<b>Application No.</b> 10/565,916	<b>Applicant(s)</b> CHENG ET AL.	
	<b>Examiner</b> Stephen W. Smoot	<b>Art Unit</b> 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 October 2010.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,2,4,7-12,15-17,19,20,22 and 24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,4,7-12,15,16,19,20 and 24 is/are rejected.
- 7) ☒ Claim(s) 17 and 22 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 January 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                       | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>10-20-10</u>  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

This Office action is in response to applicant's amendment filed on 21 October 2010.

### ***Claim Objections***

1. Claim 1 is objected to because of the following informality:

In claim 1, line 16, change "clamping form" to --clamping force-- to correct spelling.

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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3. Claims 1, 4, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1) in view of Bottini (US 3,808,673) and Chaudhury et al. (US 2003/0145940 A1).

Referring to Figs. 1-10 and paragraphs [0051] to [0071], Hirano et al. disclose a semiconductor device that includes a semiconductor chip (7A) mounted onto a surface of a substrate (1) using an adhesive (9), bond wires (10) to electrically connect the chip (7A) to the substrate (1), a silicone-containing overmold resin (11) to seal the chip (7A) (see paragraph [0065]), and solder balls (12) on an opposite surface of the substrate (1). Referring to Figs. 11-13 and paragraphs [0072] to [0079], Hirano et al. further disclose that the semiconductor device can be formed by using adhesive (9) to mount the chip (7A) to a plastic film (20), connecting bond wires between the chip (7A) and the plastic film (20), placing this assembly in a mold (30) to apply the silicone-containing overmold resin (11) directly to the chip (7A), the bond wires (10), and to the plastic film (20) by injection molding, applying solder balls (12) to the opposite surface of the plastic film (20), and cutting the plastic film (20) into a substrate (1). These are limitations as set forth in claims 1, 4 of the applicant's invention.

However, Hirano et al. lack specific details regarding their injection molding process that includes heating the mold cavity (a limitation of claim 1), curing the die attach adhesive (a limitation of claim 1), using a silicone viscosity of 80 to 3000 Poise (a limitation of claim 4), a cured over mold of the silicone composition having a modulus of 25 to 1000 MPa (a limitation of claim 4), and curing for 30 to 120 seconds at 80 to 240 degrees C (limitations of claim 4). Further, Hirano et al. lack the limitations of plasma

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treating a surface of the die attach adhesive, plasma treating a surface of the semiconductor die, and contacting these plasma treated surfaces with each other, which are also limitations as set forth in claim 1 of the applicant's invention.

Bottini teaches that a semiconductor device can be packaged by injection molding a silicone resin by curing for 120 to 150 seconds at a mold temperature of 190 degrees C (see column 4, lines 25-43). Chaudhury et al. teach that surfaces of an adhesive and a semiconductor can be plasma treated in order to improve adhesion between the surfaces (see paragraphs [0017] to [0034]).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Hirano et al. and Bottini in order to use the injection molding parameters, as taught by Bottini, for sealing the package of Hirano et al., because Bottini shows that these are known parameters for injection molding silicone resin. It also would have been obvious to further combine the teachings of Hirano et al. and Bottini with those of Chaudhury et al. in order to plasma treat the adhesive surface and chip surface for improved adherence.

Regarding the silicone viscosity and the modulus of the cured silicone composition ranges of claim 4, these are property limitations that are presumed to be inherent to the combination of Hirano et al. Bottini, and Chaudhury et al., per MPEP section 2112.01, because the process for producing the silicone-containing resin of this combination is substantially identical to applicant's claims 1, 4. Accordingly, per MPEP section 2112, part V, the burden is shifted to the applicant to show an unobvious

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difference between their as-claimed invention and the combination of Hirano et al., Bottini, and Chaudhury et al.

Regarding claim 19, the cure speed and temperature ranges of 30 to 60 seconds at 80 to 150 degrees C are outside of the ranges taught by Bottini. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to further modify the combination of Hirano et al., Bottini, and Chaudhury et al. in order to use cure speed and temperature ranges required by claim 19 through routine experimentation to discover the workable ranges of the combination [see *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)].

4. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1), Bottini (US 3,808,673), and Chaudhury et al. (US 2003/0145940 A1) as applied to claim 1 above, and further in view of Takeuchi et al. (US 6,475,629 B1).

As shown above, the combination of Hirano et al., Bottini, and Chaudhury et al. has all of the limitations as set forth in claim 1 of the applicant's invention. However, this combination does not expressly teach or suggest that the die attach adhesive includes silicone, which is the further limitation to claim 1 as set forth in claim 2 of the applicant's invention. Takeuchi et al. teach that a die attach adhesive (4) can include a siloxane-based resin (see Fig. 5 and column 14, line 54 to column 15, line 6).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Hirano et al., Bottini,

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Chaudhury et al., and Takeuchi et al. in order to include silicone material in the die attach adhesive like the siloxane resin of Takeuchi et al., because Takeuchi et al. recognize that the siloxane resin exhibits strong adhesion (see column 25, lines 46-54).

5. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1), Bottini (US 3,808,673), and Chaudhury et al. (US 2003/0145940 A1) as applied to claim 1 above, and further in view of Fishley et al. (US 6,654,248 B1).

As shown above, the combination of Hirano et al., Bottini, and Chaudhury et al. has all of the limitations as set forth in claim 1 of the applicant's invention. However, this combination does not expressly teach or suggest that the mold has a gate configured to introduce the curable liquid onto a middle of a top of an assembly that includes bond wires, which is the further limitation to claim 1 as set forth in claim 20 of the applicant's invention. Fishley et al. teach that liquid molding compound (20) can be injected through a mold (24) that has a centrally located top gate (26) for encapsulating an integrated circuit (16) and bond wires (18) (see Figs. 1, 3, 4, column 3, lines 10-26, and column 4, lines 10-21, 36-43).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to further modify the combination of Hirano et al., Bottini, and Chaudhury et al. in order to use a mold with a centrally located top gate, as taught by Fishley et al., because Fishley et al. show that such a configuration is effective for encapsulating a wire bonded integrated circuit.

6. Claims 7-12, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1) in view of Bottini (US 3,808,673) and Shimizu et al. (US 4,722,968).

Referring to Figs. 1-10 and paragraphs [0051] to [0071], Hirano et al. disclose a semiconductor device that includes a semiconductor chip (7A) mounted onto a surface of a substrate (1) using an adhesive (9), bond wires (10) to electrically connect the chip (7A) to the substrate (1), a silicone-containing overmold resin (11) to seal the chip (7A) (see paragraph [0065]), and solder balls (12) on an opposite surface of the substrate (1). Referring to Figs. 11-13 and paragraphs [0072] to [0079], Hirano et al. further disclose that the semiconductor device can be formed by using adhesive (9) to mount the chip (7A) to a plastic film (20), connecting bond wires (10) between the chip (7A) and the plastic film (20), placing this assembly in a mold (30) to apply the silicone-containing overmold resin (11) by injection molding, applying solder balls (12) to the opposite surface, and cutting the plastic film into a substrate (1). These are limitations as set forth in claims 7-8, 16 of the applicant's invention.

However, Hirano et al. lack specific details regarding their injection molding process including the clamping force between 1 to 80 tons (a limitation of claims 7, 16) or, more specifically, between 1 to 27 tons (the limitation of claim 9), an injection pressure between 0.3 to 7 MPa (a limitation of claims 7, 16), and heating the mold cavity (a limitation of claims 7, 16). Further, Hirano et al. lack an addition reaction curable liquid silicone composition, a silicone viscosity of 80 to 3000 Poise and a cured



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product of the silicone composition having a modulus of 100 to 1000 MPa, which are limitations of independent claims 7, 16.

Bottini teaches that a semiconductor device can be packaged by injection molding and that the mold material can be silicone resin that can be cured for 120 to 150 seconds using a mold temperature of 190 degrees C, using a pressure of 600 psig (i.e about 4 MPa), and using a clamping force of 15 tons (see column 4, lines 25-43). Shimizu et al. teach that addition reaction curable liquid silicone compositions are known in the art (see column 1, lines 15-28).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Hirano et al. and Bottini in order to use the molding parameters, as taught by Bottini, for sealing the package of Hirano et al. by injection molding, because Bottini shows that these are known parameters for molding silicone resin.

Regarding claim 10, Hirano et al. do not expressly teach or suggest that the cured silicone-containing resin is optically clear. Bottini teaches that a clear silicone resin can be used to optically couple a light emitting diode to a detector (see column 3, line 66 to column 4, line 24). Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the teachings of Hirano et al. by using an optically clear silicone resin, as taught by Bottini, in order to transmit light into or out of the sealed package disclosed by Hirano et al.

It also would have been obvious to a person of ordinary skill in the art at the time the invention was made to further modify the combination of Hirano et al. and

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Bottini in order to use an addition reaction curable liquid silicone composition, as taught by Shimizu et al., because Shimizu et al. recognize that such silicone compositions can advantageously be rapidly cured and they also have excellent mechanical strength (see column 1, lines 26-28). Regarding the silicone viscosity and the modulus of the cured silicone composition, these are property limitations that are presumed to be inherent to the combination of Hirano et al., Bottini, and Shimizu et al., per MPEP section 2112.01, because the process for producing the silicone-containing resin of this combination is substantially identical to applicant's claims 7, 16. Accordingly, per MPEP section 2112, part V, the burden is shifted to the applicant to show an unobvious difference between their as-claimed invention and the combination of Hirano et al. and Bottini.

Regarding claims 11-12, the combination of Hirano et al., Bottini, and Shimizu et al. lacks the specific mold temperature range as set forth in claim 11 or the injection pressure range as set forth in claim 12. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the combination of Hirano et al., Bottini, and Shimizu et al. in order to use a mold temperature within the range of claim 11 and/or an injection pressure within the range of claim 12 through routine experimentation to discover the workable ranges of the combination [see *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)].

7. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1) in view of Bottini (US 3,808,673).

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Referring to Figs. 1-10 and paragraphs [0051] to [0071], Hirano et al. disclose a semiconductor device that includes a semiconductor chip (7A) mounted onto a surface of a substrate (1) using an adhesive (9), bond wires (10) to electrically connect the chip (7A) to the substrate (1), a silicone-containing overmold resin (11) to seal the chip (7A) (see paragraph [0065]), and solder balls (12) on an opposite surface of the substrate (1). Referring to Figs. 11-13 and paragraphs [0072] to [0079], Hirano et al. further disclose that the semiconductor device can be formed by using adhesive (9) to mount the chip (7A) to a plastic film (20), connecting bond wires (10) between the chip (7A) and the plastic film (20), placing this assembly in a mold (30) to apply the silicone-containing overmold resin (11) by injection molding, applying solder balls (12) to the opposite surface, and cutting the plastic film into a substrate (1). These are limitations as set forth in claim 15 of the applicant's invention.

However, Hirano et al. lack specific details regarding their injection molding process including the clamping force between 1 to 80 tons, an injection pressure between 0.3 to 7 MPa, heating the mold cavity, and curing the die attach adhesive, which are limitations of claim 15. Further, Hirano et al. lack a silicone viscosity of 80 to 3000 Poise and a cured product of the silicone composition having a modulus of 100 to 1000 MPa, which are also limitations of independent claim 15.

Bottini teaches that a semiconductor device can be packaged by injection molding and that the mold material can be silicone resin that can be cured for 120 to 150 seconds using a mold temperature of 190 degrees C, using a pressure of 600 psig (i.e about 4 MPa), and using a clamping force of 15 tons (see column 4, lines 25-43).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Hirano et al. and Bottini in order to use the molding parameters, as taught by Bottini, for sealing the package of Hirano et al. by injection molding, because Bottini shows that these are known parameters for molding silicone resin. Regarding the silicone viscosity and the modulus of the cured silicone composition, these are property limitations that are presumed to be inherent to the combination of Hirano et al. and Bottini, per MPEP section 2112.01, because the process for producing the silicone-containing resin of this combination is substantially identical to applicant's claim 15. Accordingly, per MPEP section 2112, part V, the burden is shifted to the applicant to show an unobvious difference between their as-claimed invention and the combination of Hirano et al. and Bottini.

8. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1) and Bottini (US 3,808,673) as applied to claim 15 above, and further in view of Barrow et al. (US 4,802,873).

As shown above, the combination of Hirano et al. and Bottini has all of the limitations as set forth in claim 15 of the applicant's invention. However, this combination does not expressly teach or suggest that the mold has a gate configured to introduce the curable liquid into a side corner of a mold cavity, which is the further limitation to claim 15 as set forth in claim 24 of the applicant's invention. Barrow et al. teach that liquid silicone compound can be injected into a cavity (23) through a hole

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(22b) formed in a corner of a mold (18) in order to encapsulate an electroluminescent layer (see Figs. 4, 5, and column 2, line 60 to column 3, lines 10-21, 36-43).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to further modify the combination of Hirano et al. and Bottini in order to use a gate configured to introduce curable liquid at a side corner of a mold cavity, as taught by Barrow et al., because Barrow et al. show that such a configuration is effective for encapsulating electronic devices.

### ***Allowable Subject Matter***

9. Claims 17, 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims.

10. The following is a statement of reasons for the indication of allowable subject matter: The prior art of record does not teach or suggest, in combination with the other claim limitations, a method that includes applying a silicone die attach adhesive composition to a substrate, using the adhesive to attach a semiconductor die to the substrate, and injection molding a curable liquid comprising a silicone composition over the semiconductor die/substrate assembly, wherein the silicone die attach adhesive composition and the curable liquid have similar cure mechanisms such that groups reactive with the curable liquid are present in the die attach adhesive.

### ***Response to Arguments***

11. Applicant's arguments filed 21 October 2010 have been fully considered but they are not persuasive.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "injection conditions to prevent wire sagging or wire flow problems", "conditions for injection molding of a device with wire exposed", and with specific regards to claims 1-2, 4, 15, 19-20, 24 "an addition-reaction curable liquid silicone composition") are not recited in the rejected claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). It is also emphasized that wire bonding is not a claim requirement for claims 7-12, 16 and it is claimed as an optional step for claims 15, 24, which means that it is not required for claims 15, 24.

In response to applicant's argument that there is no teaching, suggestion, or motivation to combine the references, the examiner recognizes that obviousness may be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988), *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992), and *KSR*

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*International Co. v. Teleflex, Inc.*, 550 U.S. 398, 82 USPQ2d 1385 (2007). In this case, Hirano et al. and are combinable because Bottini shows that injection molding is one way to seal a package with curable silicone resin, and are further combinable with Chaudhury et al. who recognize that plasma treating two surfaces will improve adhesion between these surfaces, with Takeuchi et al. who recognize that using silicone in die attach adhesive increases bonding strength, with Fishley et al. who show that using a centrally located top gate is a known configuration for injecting liquid molding compound, with Shimizu et al. who recognize that addition reaction curable liquid silicone compositions can advantageously be rapidly cured and also have excellent mechanical strength, and/or with Barrow et al. who show that injecting liquid silicone compound through a hole formed in a corner of a mold is a known way to encapsulate electronic devices.

### ***Conclusion***

12. Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 571-272-1698. The examiner can normally be reached on Monday to Friday from 8:00am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew C. Landau can be reached on 571-272-1731. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Stephen W Smoot/  
Primary Examiner  
Art Unit 2813

SWS